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# ENROLLING ACTORS IN THE CO- EVOLUTON OF INTER-ORGANISATIONAL INFORMATION SYSTEMS

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# ENROLLING ACTORS IN THE CO-EVOLUTION OF INTER-ORGANISATIONAL INFORMATION SYSTEMS

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## Abstract

*This paper describes interpretive case-study research into the development on some e-commerce inter-organisational information systems (EIOS) implemented in Australia. The research was undertaken in two phases, firstly a thematic analysis in ten organisations, and secondly an in-depth case study of one of these organisations using co-evolutionary theory. A framework of EIOS evolution is developed and offered as a tool for practitioners working as initiators of EIOS.*

*Keywords: co-evolution, inter-organisational systems, IS development*

# **1 THE IMPORTANCE OF INTER-ORGANISATIONAL SYSTEMS**

Communication and collaboration among organisations has always been a crucial part of social activity. Wholesalers communicate with manufacturers, importers and retailers; motor leasing firms communicate with automobile suppliers, client companies and individual leasers; university admissions centres communicate with school examination boards and other universities. Traditionally this communication has been achieved through a combination of sales representatives and semi-structured documents such as catalogues, orders, leasing agreements and academic transcripts. With the advent of widely available internetworks and reasonably compatible IT platforms, it became possible for organisations to engage in much more intimate communication. Venkatraman (1991, pp 141-144) proposed that, once internal IT systems were more or less integrated, one of several potentially parallel strategies would be the redesign of business networks, involving both a new agreed level of collaboration and the partial integration of IT systems across organisations. Integration can be at the levels of automated transactions, integrated inventory management, trans-organisational business processes and shared expertise. Some of the expected benefits for participants in business network redesign are increased efficiency, improved ability to cope with complexity, and better market positioning.

Since the publication of Venkatraman's work IT-enabled business network redesign has become widely adopted, under names such as supply-chain management (SCM), electronic data interchange (EDI), business-to-business (B2B) e-commerce, e-procurement and supplier portals. Although the individual labels and objectives may differ, these initiatives share a common challenge in needing to engage trading partners in a manner timely enough such that the return on the investment for the system is not compromised, and substantive enough to provide a long-lasting outcome. Unfortunately, in Australia as elsewhere, the reality has not always lived up to the promise. The inability to achieve timely and substantive engagement of trading partners has frequently been a decisive factor in determining whether initiatives are successful, or even viable enough to go ahead in the first place. A practitioner implementing an EDI system in the early 1990's observed: "expanding trading partners seems more difficult than implementing EDI in the first place" (Stelzer 1993, p 43 in Iacovou, Benbasat & Dexter 1995). A representative of the Australian Leisure and Hospitality Group recently described implementing an inter-organisational finance and reporting system across 690 liquor outlets as "a monumental task" (Mills 2006b). Orica, an explosives and chemicals company, hoped to get all business customers placing orders over the web directly from their accounting packages, but noted that this involved convincing "thousands of tradespeople and small businesses that it is economically worthwhile" (Hayes 2006). Coles Myer, one of Australia's largest retailers, in 2003 allocated AUD 604 million to overhauling its supply and distribution systems, with a large part of this allocated to electronic trading with suppliers (Frew 2003; Woodhead 2004). Although it has thousands of suppliers for the products that stock its supermarket shelves, Coles Myer took two years to achieve data synchronisation with the first 300 (Mills 2006a). Disparities between goals and actual achievement have been particularly dramatic in e-procurement systems initiatives (Braue 2004).

As with most information systems development, business strategies and organisation culture and politics are more important issues than technical design and capability. This is particularly salient when working across several partner organisations. Successful engagement goes beyond just the decision to adopt, and it requires much more than just technical systems connectivity: it requires trading partners to make and accept adjustments to their established business processes. Process reengineering can represent a far greater challenge than implementing the technologies, as Yen & Ng (2002) demonstrated in the context of inter-organisational e-procurement systems in the Hong Kong textile industry. A representative of Corporate Express, a multinational office products company that invested heavily in integrated e-

commerce with its trading partners, recently summed up the experience with the comment: "the biggest issues haven't been technical, they've been aligning business processes" (Bushell 2004, p 4).

The lead author of this paper has been involved in advising management who are implementing e-commerce inter-organisational systems (EIOS). Senior managers repeatedly emphasised the substantial and unexpected challenges encountered as they worked to engage trading partners. The challenges were much greater than initially anticipated and had required them to undertake expensive customisation of systems to suit different trading partners, make significant commitments to interactions between managers at multiple levels, and initiate a variety of schemes to assist trading partners during the transition. The purpose of the research reported was to help people like these - the managers charged with initiating and developing e-commerce systems - to move beyond the application of intra-organisational and traditional IS strategies and offer them alternatives better suited to inter-organisational initiatives. It set out to answer the following question:

What new enabling strategies for practitioners could help facilitate the successful engagement of trading partners in e-commerce inter-organisational systems?

An iterative research approach was used. In the first phase, extensive interviews were conducted with systems initiators (executives identified as having overall responsibility for the e-commerce system within the initiator organisation) and their trading partners from ten Australian e-commerce inter-organisational systems, covering a range of industries and business processes. While the systems studied were all operational (thus excluding systems that had already failed), the emphasis was on understanding the enablers of engagement, and the sample appeared to be more than adequate for this purpose: it included systems where some trading partners had been engaged successfully while others had not, and systems that had struggled through difficult periods in their history.

Transcriptions of the interviews were interpreted through hermeneutic analysis (Myers & Avison 2002, p 11) and common themes were identified (Boyatzis 1998). Based on the themes that emerged and the issues identified from the literature, it was decided to apply a co-evolutionary model to the process of partner engagement. This was implemented in a detailed case study of one of the EIOS, with further interviews that were designed to capture all the decisions, events and changes that were important in the history of the system and engagement of trading partners. Further hermeneutic analysis, informed by the co-evolutionary framework of Rosenkopf & Nerkar (1999), led to the elucidation of a number of previously unidentified issues in EIOS development, such as the importance of the communities applying selection processes to the evolution of the system, the need to enrol routines as well as technical components, and the relative importance of chance and intention.

From this interpretation a new framework is offered, to aid practitioners in their understanding of EIOS development.

## **2 STUDYING INTER-ORGANISATIONAL ADOPTION**

This section gives a very brief summary of the literature on inter-organisational information systems. This literature can be considered as falling into four groups. Empirical studies reviewed included both surveys and qualitative case studies covering a period from 1990 (Reich) to 2004 (Power), which suggested a multitude of factors affecting adoption, including cost, top management support, organizational compatibility, risk-taking in management, size of firm, sophistication of IS infrastructure, understanding the role of standards, realistic cost estimates, management attitude, linking plans to corporate strategy, early user involvement, user resistance, education and internal communication strategies, competitive pressure, customer support, perceived benefits, perceived competitive advantage, prior experience of EDI, perceived support from the vendor, organisational readiness, knowledge and skill levels, organisational

resources, effective management of human resources, trading partner pressure, trust, effective communications, politics, power relations, pilot tests, having a champion, clarity of contractual arrangements, progressive phasing in of systems, data standards, extent of integration between EDI and other systems, and provision of technological assistance. Many of these factors are relevant to the adoption of almost anything, and their relative importance varies from project to project. It is no wonder that Scupola (2002) found that the most important factor for successful adoption was chance.

Other studies take a more theoretical approach. Economic theories used include transaction cost analysis (Williamson 1994), resource dependency theory (Pfeffer & Salancik 1978), and interdependent benefits for participants (Riggins & Mukhopadhyay 1994). Unfortunately, in actual EOIS development projects it is impossible to get accurate data to feed these economic models. The most common theoretical model used in studies of implementation is Rogers's (1983) diffusion of innovation model. Authors who have applied this model to EOIS include Premkumar, Ramamurthy & Nilakanta (1994) in a major study of EDI implementation in the US, Munkvold (1998) who used innovation diffusion principles to study two systems where collaborative technology was being implemented between small and medium-sized businesses, and Dreidonks, Gregor, Wassenaar & van Heck (2005) who used the theory to analyse adoption of B2B electronic marketplaces. Most of these studies identified critical factors for successful implementation but, as mentioned above, taken together they offer an impossibly large number of factors that an implementation manager is urged to consider.

A variety of more socially oriented theories have been applied to EOIS implementation. Institutional theory, which focuses on the way in which organizational roles become socially entrenched expectations, was used by Chatterjee, Grewal & Sambamurthy (2002) to examine factors in achieving higher levels of organization assimilation of web technologies, and by Cousins & Robey (2005) to analyse the role of intermediaries in B2B e-commerce. Kumar & van Dissel (1996) examined inter-organisational systems from the perspective of managing co-operation and conflict between organisations, Hart & Saunders (1997) analysed adoption and use of EDI from the perspective of trust and power, while Ibbott & O'Keefe (2004) examined the role of trust in the planning, development and implementation of two inter-organisational systems, including the role of boundary-crossing individuals in promoting trust; Brown & Lockett (2004) suggested that trust could also be contributed by third party intermediaries, such as service providers.

Most of the literature concentrates on the initial conditions necessary for a successful EOIS rather than on what happens (or should happen) during the process of implementation. Further, the studies usually start with an existing theory, model or list of potential factors, and this limits what can be discovered about the actual issues encountered during implementation. In the first phase of our research we tried to avoid pre-conceptions, allowing themes to emerge from the analysis of the interview data.

### **3 THEMES FOR ENGAGEMENT IN EOIS**

Table 1 shows the main themes emerging from the analysis of the interviews with systems initiators and their trading partners. The ten systems studied were in industries such as finance, manufacturing, construction and telecommunications, and had taken an average of five years to develop. The processes involved were mainly quoting, pricing and ordering, but also included invoicing, reporting and project co-ordination. Since the interviewees were managers who were directly responsible for various aspects of the system implementation, the comments tend to focus on difficulties rather than overall company costs and benefits.

The most strongly expressed themes are summarised in the table. Some of these were raised for almost all the systems studied, while other were extremely important to just one or two of the organisations. The themes are listed in apparent order of importance to the interviewees.

Theme	Description
1. Acting to achieve a fair distribution of benefits and costs	Perceived benefits and costs were a strong theme in all 10 cases, with almost every respondent discussing engagement in terms of what the system did or would do for their organisation. Distributing benefits and costs fairly between initiators and trading partners was critical: differences significant enough to be perceived as unfair slowed engagement.
2. Avoiding the duplication of existing processes / rationalising already duplicated business processes	A strong theme in 9 of the 10 cases. Trading partner respondents described duplication of existing processes as reducing their motivation to adopt or make further use of a system. A common example of duplicated business processes was the requirement to re-enter data into an e-commerce IOS that had already been entered into an internal system. Trading partners in these cases were much less likely to be engaged with the e-commerce IOS.
3. Creating effective communication channels to receive and act upon feedback from trading partners	A theme in all 10 cases was the need to solicit feedback from trading partners and to act upon it by adjusting the system and/or the way engagement was undertaken. Trading partner respondents frequently described the availability of feedback channels, and the willingness of initiators to listen and act upon them, as a critical factor in engaging with the system. Successful system initiators all implemented many changes and revisions to systems over time.
4. Pre-packaging and removing complexity from the system, its implementation and the engagement process	Simplifying, pre-packaging and removing complexity helped the engagement process. This was a strong theme in 6 cases. It applied to system design, information and communications relating to the system, demonstrations of the system and the implementation process for the system. In 3 cases, pre-packaged system demonstrations helped trading partners grasp implications and potential benefits. In 2 cases, reducing the number of system options available accelerated engagement. This was relatively more important when engaging small business trading partners, because the decision-makers tended to make more immediate adopt/reject decisions.
5. Minimising the organisational change required of trading partners	Minimising organisational change was a theme in 5 cases, and an especially important enabler for trading partner engagement in 3 of these. References related to the difficulty of changing established procedures built around financial systems and entrenched workplace practices. Decreasing the changes asked of trading partners increased the likelihood of successful engagement. In one case, breaking down the required changes into smaller, manageable steps was an important enabler.
6. Targeting specific people / job roles within trading partners	Targeting the right people / job roles within trading partners was strongly linked to successful engagement outcomes in 7 cases. References were made to job roles such as logistics managers, billing managers, project directors, purchasing officers, content managers and designers, depending on the context. IT managers were sometimes acknowledged as important, but the primary targets for successful engagement were always business roles.
7. Using the most appropriate staff to engage trading partners	Identifying and selecting the right personnel to 'sell' the system to trading partners was an important enabler in 6 cases. This extended beyond having the right personal qualities to the nature of the job role itself. Better results were achieved when people were used with the same professional background as the personnel targeted. Appointing a specialised person/team to own the process of taking the message to trading partners was a valuable enabler in 4 cases. Asking regular account managers to do this generally led to poor outcomes.
8. Using other organisations to assist in the engagement process	Positive and negative assessments of systems, received from trusted peers in the trading partner community, had considerable impact on engagement in 4 cases. This was partly because trading partners sought to reduce risk by waiting to learn from the experiences of others, and partly because of competitive pressures (the desire not to be left behind their peers).

9.	Segmenting the engagement strategy for different categories of trading partner	This was a strong theme in 5 cases, and a weak theme in 3 others. Segmentation was undertaken using a variety of criteria. The technical capability of trading partners was the most common consideration. Other criteria included transaction volumes, different business models of trading partners and relative benefit to trading partners. Segmenting on the basis of business size alone, without assessing technical capabilities, was not useful.
10.	Identifying competing priorities in partner organisations	The timing of engagement with respect to competing priorities within the target organisation was a theme in 4 cases. When other priorities dominated management thinking, any new e-commerce project, even if recognised as valuable and viable, could not gain traction.
11.	Providing trading partners with assistance and technical support	In 3 cases initiators achieved positive results by providing proactive technical assistance and sending experts out to trading partner premises to do some or all of the work necessary to implement the system. This represented an adaptation to the strategy to overcome early disappointments.
12.	Addressing trading partner concerns over independence and lock-in	Concerns about e-commerce systems increasing dependence on the initiator, increase the initiator's market power and/or make it more difficult to dismantle a trading relationship in future, were expressed by 4 trading partner respondents. For these organisations it was a critical factor in engagement.
13.	Coercion from system initiators	Coercion was a theme in 3 cases. In one of these it was a very strong theme referenced multiple times by every trading partner respondent. It was a key factor in promoting initial take-up, but it also led to resentment, and trading partners were subsequently predisposed to limiting their use of the system.
14.	Subsidisation from system initiators	Direct financial subsidies were used extensively in one case and mentioned by a single trading partner in another case, but engagement results were not clear cut.
15.	Meeting initial and ongoing system performance expectations	Performance of the system was a strong theme, mentioned by almost all trading partner respondents, in 1 case. Although the system response times appeared to be relatively reasonable on the surface, the real problem was that they had fallen well short of expectations. This substantially slowed the rate of take-up.
16.	Adjusting to the value propositions that are important to different trading partners	Benefits for trading partners, and reasons for engaging, varied greatly between cases. They included additional revenues, cost savings, more rapid business outcomes, time savings, reduced errors, reduced workload, better quality of information and deeper relationships. Most interestingly, reasons also varied greatly within each case: different trading partners often engaged for very different reasons depending on their circumstances and organisational priorities.
17.	Removing uncertainties from the trading partner business case	A theme in 3 cases. Trading partners did not engage because they could not determine if it would produce a net benefit to their organisations. In one case the initiator improved engagement outcomes by individually assisting trading partners to develop their business case.
18.	Support within the system initiator organisation	In 3 cases the engagement process was interrupted by interdepartmental conflicts within the initiator organisation. In two of these, conflicts were between business units and the IT department.
19.	Providing training to trading partners	Training was specifically employed as a method of increasing take-up in 4 cases, but results were poor. Successful engagement was much more closely linked to how straightforward a system was to use/self learn (see 'removing complexity from the system').
20.	Other minor themes	Other, minor themes included: achieving better engagement outcomes when trading partners had already experimented with e-commerce initiatives and/or developed an e-commerce strategy; the ability for one person to derail engagement; more costly engagement when trading partners had poorly maintained data in their internal systems.

*Table 1. Major themes emerging from interview analysis in phase 1*

A table was also constructed (not included here) that documented major turning points in each implementation project. Interestingly, in only one case was a turning point related to one of the major themes identified in Table 1.

Many of the above themes (such as cost, complexity and top management support) correspond to factors previously identified in the literature. The importance of avoiding duplication of activities (theme 2), however, has not been previously emphasised in the literature, possibly because many previous studies neglected the details of implementation. Other themes that were emphasised in this study were fairness in the distribution of costs and benefits among partners, benefits for customers, effective communication and feedback from partners, and the importance of finding the right contact person within each trading partner.

The finding that is not apparent from table 1 is the varieties of uniqueness in the EIOS implementation process. Firstly, for each EIOS quite different themes or factors are more or less important. Secondly, the salient issues differ for each trading partner in a single EIOS. Adoption decisions were rarely clear cut and rarely attributable to a single person; adoption was a drawn out process involving many small decisions made by many people, with different value propositions applied by different trading partners in the same system, so the nature and rationale for their decisions varied. Thirdly, the important issues and even the nature of the EOIS changed during the implementation process. This became apparent in the analysis of turning points. In most cases big turning points had been associated with changes in the technology used, or even complete redesigns of the system; in many cases even the purpose of the system had been extensively revised, either with new capabilities added or by shifting the development effort to one function over others.

From this confirmation of the clear particularity of each moment in each EIOS implementation, it is apparent that what could help the practitioner is neither a list of success factors nor a theory that concentrates on one aspect of the phenomenon, but a model that assists in understanding and responding to the EIOS (in all its social and technical complexity) as it evolves.

## **4 CO-EVOLUTION AND EIOS**

After considerable investigation, we decided that co-evolution would be a useful model to apply in interpreting the themes that emerged in phase 1 of the study. While they did not explicitly use such a model, Chatterjee, Grewal & Sambamurthy (2002, p-66) noted that:

The effective assimilation of web technologies requires their integration into existing organizational work processes and this might necessitate changes to current technologies and work processes...however not many firms succeed in orchestrating the co-evolutionary changes to their technologies-in-use, organizational structures, processes, and incentive and reward systems to successfully assimilate Web technologies into their e-commerce initiatives.

The first scholarly use of the term 'co-evolution' is ascribed to Erlich & Raven (1964) in their study of the evolutionary interaction between butterflies and plants. It refers to cases where there is two-way feedback between the evolutionary pathways of two species, with each applying selection pressure to variations in the other, in such a way as to encourage mutually beneficial behaviour. In the study of organisations and technology co-evolutionary theory has been applied to selection of technology, and to changes in roles, routines and strategies. Yetton, Johnston & Craig (1994) studied an architectural firm where design and architecture information systems were updated, finding that the business strategy was an outcome rather than a driver of change, with the change process emerging incrementally, on a project-by-project basis. Kay & Cecez-Kecmanovic (2001) examined the effect of an information system implementation on a company, and the company on the information system in order to provide a deeper understanding of processes that underpin the resulting competitive advantages. Peters, Heng & Vet (2002) studied the



evolution of an IS strategy within a leasing company and found the IS and organisational change coevolved, without the adoption of formal strategies or planning methods. Rosenkopf & Tushman (1988) used a combination of population and organisation level analysis to explore how inter-organizational communities co-evolved with technology in the flight simulation industry, while Van de Ven & Garud (1994) studied co-evolution of technical and institutional events and characterised different phases in the evolution of an innovation (cochlear implants) by the type of evolutionary events (variation, selection, retention, struggle) that dominated.

The model used to inform the analysis of phase 2 of this study was that of Rosenkopf & Nerkar (1999), who proposed a three level analysis for technological co-evolution where, instead of using organisations, populations and communities, they selected and defined levels around the technology, analysing the evolution of optical disc technology using system, product and component levels. Components, such as lasers or digital signal processors, form the basic building blocks for entities at higher levels; products are the logical assemblies of technological components. Because products are composed of multiple components, interdependence between components strongly affects the evolution of products, and multiple component-specific communities are involved in the technological evolution of any given product. Products are coordinated into systems of use. In the case of the optical disc industry, storage discs and players are combined to form systems in this way. Standards—in the optical disc industry format standards such as compact disc (CD) and digital versatile disc (DVD)—are the most obvious markers of system level evolution.

Variation, selection and retention processes operate simultaneously at each of the three levels and interdependent technological entities co-evolve *within* each level of the hierarchy (within-level co-evolution). Bundling and coordination of components means that developments in some components spur developments in others. Similarly, product innovations spur innovations in other products that they are bundled with in systems. Sometimes reverse salients occur (Hughes 1983) when one component lags development of other components in a product, leading firms to focus on overcoming the bottleneck. In the optical drive industry, CD storage capacity lagged laser and optical reader components and held back progress for optical drive products. Variation, selection and retention processes also interact *between* levels in the hierarchy, with evolution at one level causing evolution across other levels (cross-level co-evolution). Downward causation occurs where the selection of higher level entities produces selection events in lower-level entities as well. Thus components do not just follow trajectories shaped by component-level forces, but are also influenced by forces operating at higher levels, such as firm-level decisions regarding the bundling of components

Our intention in phase 2 was to see how the Rosenkopf & Nerkar model could be used to make sense of one EOIS case (Omicron). Further interviews were conducted with managers from the EOIS initiators, five of the trading partners, and the IT company that was implementing the technical aspects of the system. The same general method of data collection and analysis was used as in phase 1, but this time with prompts that were designed to capture all the decisions, events and changes that were important in the history of the system and engagement of trading partners. The single case chosen for phase 2 was the Australian subsidiary of an international supplier of industrial cleaning equipment, with around 200 employees (including an internal IT department of 3) and a turnover of about 90 million AUD. Most sales were made through 900 distributors, while 15% of sales were direct to a small number of very large (mostly government) customers. Of the 900 distributors, 180 were regarded as significant and just 3 accounted for 30% of sales. The distributors were not tied to the company; they offered products at different prices and also sold competing products.

The move to EOIS started in 1998, with the establishment of an online shopping mall on the company's server, where distributors were given pages where they could accept orders which were then transferred to the company's ordering system. This was technically the most feasible approach at the time and

streamlined ordering for the system initiators, but did not integrate with the IT systems of the trading partners. The immediate reason for rejection of the system by the trading partners was, however, the exposure of an ambiguity in the agreed level of business collaboration - the company was unwilling to let the trading partners advertise competitors' products on their web pages.

By 2002 it was possible to contemplate installing systems at trading partners' sites, which would accept orders and transmit them to the company. The largest trading partner was chosen as the first participant, and considerable effort was put into tailoring the system to their needs. When it became clear that the same effort would be required for the second and subsequent participants, implementation was indefinitely postponed as uneconomical. Within a few months a new customer service manager had been appointed and simpler and cheaper technology became available; perhaps because of an assumed difference in power relationships, it was decided to offer a new system to smaller distributors. Initially only three distributors took up the offer, and it became apparent that there were problems with process integration that necessitated re-keying of orders. Over the next year this and a number of other process problems had been solved and twelve distributors had been enrolled. At this stage the CEO became actively involved and the improvements were consolidated in a new system release. Within six months the number of participating distributors had tripled.

This very brief summary of the history of implementation shows that at various stages the critical factors fluctuate between the technical and the social, and may operate at different levels, from small program amendments to changes in available Internet technology, from order entry clerks to CEOs. As we attempted to fit these events into the Rosenkopf & Nerkar model, we constantly revised our understanding of component, product and system. The final result was the framework in the right column of Table 2.

	<b>Evolution of optical disc industry (Rosenkopf &amp; Nerkar 1999)</b>	<b>Evolution of e-commerce IOS</b>
Level 1	SYSTEM	SYSTEM
	<i>Systems</i> are composed of multiple coordinated products and solutions. <i>System-level community</i> is the selection entity. Selection is accomplished through coordinated activity of a broad community of actors. <i>Standards</i> are markers of system level evolution	<i>Trading system</i> is the combination of trading operations in play between a set of trading partners. <i>System-level community</i> of senior executives from the trading partners is the selection entity. <i>Dominant trading practices</i> are markers of system level evolution
Level 2	PRODUCT	TRADING OPERATION
	<i>Product</i> is a system of technological components. <i>Firms</i> are selection entities. Product-level variations occur when individual firms decide how they select and bundle components.	<i>Trading operations</i> are collections of routines and technologies for conducting commercial operations between trading partners. <i>Operation specific communities</i> are the selection entities. Evolution is driven by community selection, downward pressure and evolution of components.
Level 3	COMPONENT	COMPONENT
	<i>Components</i> are discrete technologies that can be combined into products. <i>Component-specific communities</i> are selection entities. Evolution is diffused, with variations & selections occurring across multiple communities.	<i>Components</i> are both discrete technologies (e.g. software modules, databases) and routines (job roles, procedures, work practices). <i>Component-specific communities</i> are selection entities. Evolution is diffused and driven by both community innovation and top down pressure.

Table 2. The emergence of our framework from the Rosenkopf and Nerkar model

The key to our adaptation of Rosenkopf and Nerkar lies at level 2. Initially we imagined that "products" would be software packages such as online ordering systems. As we analysed the case we saw that what was far more important to success was the co-evolution of business processes, and that this depended as much on personal relationships as on business logic. Thus level 2 is occupied by "trading operations", which are selected through operation specific communities, groups (often informal) within the industry engaged in particular business practices, such as procurement. This gives a model of co-evolution that takes into account both the social and technical aspects of business processes.

## **5 HOW WE ADVISE PRACTITIONERS AND RESEARCHERS**

All students of IS development are reminded that "Information Systems are the means by which organisations and people, using information technologies, gather, process, store, use and disseminate information" (Chaffey & Wood 2005, p 43), but traditional sociological and psychological theories give little guidance of how to apply this in particular cases of IS development. The political, social and technical complexity of EIOS merely emphasise the difficulties. A co-evolutionary understanding of EIOS development leads to an altogether different way of understanding what the act of "engaging trading partners in e-commerce" means. The notion of imposing a separate, Internet-based technological system onto a group of organisations was abandoned completely. Instead organisations, their routines, and their technologies are seen as intrinsic elements of a living, continuously evolving, social-technical trading ecosystem, already interdependent and already engaged. It is not engagement, therefore, that the practitioner seeks, but rather a coaxing of this ecosystem along a trajectory where trading operations become progressively more integrated.

The first advice to practitioners is to accept that the trajectory of the system is unpredictable. An understanding of co-evolution helps the practitioner get away from assumptions that they should design, plan, and attempt to impose control on such initiatives from the outset. Those who are interested in the welfare of the project as a whole (whatever that might come to mean) must use whatever opportunities become available to them to guide its trajectory. The second piece of advice, which is fairly commonplace, is to develop systems in small steps. This is not about setting milestones, but about dealing with the minimal number of trading processes and operation specific communities at any one time. One turning point in the case studied involved focussing on smaller rather than larger trading partners. The third piece of advice is to establish as many opportunities as they can for genuine two-way feedback so that they will be aware as possible of how the system is actually evolving. The framework then helps to identify at any moment at what levels and in what communities influence may be desirable and possible. In the end the system will generate its own criteria for success.

From a theoretical point of view, the derivation of this framework shows the advantages of taking an eclectic approach to understanding IS development. The Rosenkopf & Nerkar model, which is a technology-centred model from science and technology studies, has been used to focus a broad variety of general socio-theoretic ideas onto a particular set of events; and these socio-theoretic ideas have been used to bring the restricted view of technology in Rosenkopf and Nerkar back to an older definition of "the study of technique". Much work needs to be done on this approach. The obvious next step is to convince some potential EIOS initiators to embrace this framework and take part in an action research project to evaluate the framework in action. Volunteers are welcome.

## References

- Boyatzis, R. (1998). Transforming qualitative information: thematic analysis and code development. Sage Publications, Thousand Oaks, CA.
- Braue, D. (2004). Why government isn't buying e-procurement. CIO Government, September/October.
- Brown, D. & Lockett, N. (2004). Potential of critical e-applications for engaging SMEs in e-business: a provider perspective. *European Journal of Information Systems*, 13 (1), pp 21-34.
- Bushell, S. (2004). Chain of tools, CIO, 7 April. Available at [www.cio.com.au](http://www.cio.com.au).
- Chaffey, D. & Wood, S. (2005). Business Information Management. Prentice Hall, Harlow.
- Chatterjee, D., Grewal, R. & Sambamurthy, V. (2002). Shaping Up For E-Commerce: Institutional Enablers of The Organizational Assimilation of Web Technologies. *MIS Quarterly*, 26(2), pp 65-89.
- Cousins, K. & Robey, D. (2005). The social shaping of electronic metals exchanges: an institutional theory perspective. *Information Technology & People*, 18 (3), pp 212-229.
- Driedonks, C., Gregor, S., Wassenaar, A. & van Heck, E. (2005). Economic and Social Analysis of the Adoption of B2B Electronic Marketplaces: A Case Study in the Australian Beef Industry. *International Journal of Electronic Commerce*, 9 (3), pp 49-72.
- Erlich, P. & Raven, P. (1964). Butterflies and plants: a study in co-evolution. *Evolution*, v 18, pp 586-608.
- Finnegan, P., Galliers, R. & Powell, P. (2003). Applying triple loop learning to planning electronic trading systems. *Information Technology & People*, 16 (4), pp 461-483.
- Frew, W. (2003). Coles Myer unclogs its arteries for \$604m. *Sydney Morning Herald (Business)*, September 26, p 3.
- Hart, P. & Saunders, C. (1997). Power and trust: critical factors in the adoption and use of electronic data interchange. *Organization Science*, 8 (1), pp 23-42.
- Hayes, S. (2006). Keeping the paint flowing. *The Australian (IT Business)*, August 1, p 3.
- Hughes, T. (1983). Networks of Power. Johns Hopkins University Press, Baltimore.
- Iacovou, C., Benbasat, I. & Dexter, A. (1995). Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology. *MIS Quarterly*, December, pp 465-485.
- Ibbott, C. & O'Keefe, R. (2004). Trust, planning and benefits in a global inter-organizational system. *Information Systems Journal*, v 14, pp 131-152.
- Kay, R. & Cecez-Kecmanovic, D. (2001). IS-Organisation Co-evolution: The Future of IS. Proceedings of the International Conference on Information Systems (ICIS), New Orleans, Louisiana, pp 363-372.
- Kumar, K. & van Dissel, H. (1996). Sustainable Collaboration: Managing Conflict and Cooperation in Interorganizational Systems. *MIS Quarterly*, September, pp 279-300.
- Mills, K. (2006a). Untangling supply chains. *The Australian (IT Business)*, August 1, p 1.
- Mills, K. (2006b). Bottleshops hook up tills. *The Australian (IT Business)*, September 19, p 7.
- Munkvold, B. (1998). Adoption and diffusion of collaborative technology in inter-organizational networks. Proceedings of the Thirty-First Hawaii International Conference on System Sciences, v 1, pp 424-433.
- Myers, M. & Avison, D. (2002). An Introduction to Qualitative Research in Information Systems. in Myers, M. & Avison, D. (eds). *Qualitative Research in Information Systems*, Sage Publications Ltd, London.
- Peters, S., Heng, M. & Vet, R. (2002). Formation of the information systems strategy in a global financial services company. *Information and Organization*, 12 (1), pp 19-38.
- Pfeffer, J. & Salancik, G.R. (1978). The External Control of Organizations: A Resource Dependence Perspective. Harper and Row, New York.
- Power, D. (2004). The comparative importance of human resource management in the context of business to business (B2B) electronic commerce. *Information Technology & People*, 17 (4), pp 380-406.

- Premkumar, G., Ramamurthy, K. & Nilakanta, S. (1994). Implementation of electronic data interchange: An innovation diffusion perspective. *Journal of Management Information Systems*, 11 (2), pp 157-186.
- Reich, B. & Benbasat, I. (1990). An Empirical Investigation of Factors Influencing the Success of Customer-Oriented Strategic Systems. *Information Systems Research*, 1 (3), pp 325-347.
- Riggins, F. & Mukhopadhyay, T. (1994). Interdependent Benefits from Inter-organizational Systems: Opportunities for Business Partner Reengineering. *Journal of Management Information Systems*, 11 (2), pp 37-57.
- Rosenkopf, L. & Nerkar, A. (1999). On the Complexity of Technological Evolution; Exploring Co-evolution Within and Across Hierarchical Levels in Optical Disc Technology. in Baum, J. & McKelvey, B. (eds). *Variations In Organization Science; in Honour of Donald T. Campbell*, Sage, Thousand Oaks, CA.
- Rosenkopf, L. & Tushman, M.L. (1998). The Co-evolution of Community Networks and Technology: Lessons from the Flight Simulation Industry. *Industrial & Corporate Change*, 7 (2), pp 311-341.
- Scupola, A. (2002). Adoption Issues of Business-to-Business Internet Commerce in European SMEs. *Proceedings of the 35th Hawaii International Conference on System Sciences*, IEEE Computer Society, Hawaii.
- Sensis (2004). *Sensis e-Business Report: The Online Experience of Small and Medium Enterprises*. Sensis Pty Ltd., Melbourne.
- Stelzer, J. (1993). How to get partners to play. *Transportation and Distribution*, 34 (4), pp 42-44.
- Swatman, P.M.C. & Swatman, P.A. (1991). Electronic Data Interchange: Organisational Opportunity, Not Technical problem. in Srinivasan, B. & Zeleznikow, J. (eds). *Databases in the 1990's*. World Scientific Press, Singapore, pp 354-374.
- Venkatraman, N. (1991). IT-induced business re-configuration. in Scott Morton, M. *The corporation of the 1990s*. Oxford UP, New York.
- Williamson, O.E. (1994). Transaction Cost Economics and Organization Theory'. in Smelser, N. & Swedberg, R. (eds). *The Handbook of Economic Sociology*, Princeton University Press, Princeton, NJ, pp 77-107.
- Woodhead, B. (2004). Coles delivers on supply-side. *Australian Financial Review (Information)*, September 23.
- Van de Ven, A. & Garud, R. (1994). The Co-evolution of Technical and Institutional Events in the Development of an Innovation. in Baum, J. & Singh, J. (eds). *Evolutionary Dynamics of Organizations*, Oxford University Press, New York, pp 425-443.
- Yen, B. & Ng, E. (2002) Migrating Procurement onto the Internet. *Electronic Commerce Research*, 2 (1-2), pp 113-134.
- Yetton, P., Johnston, K. & Craig, J. (1994). Computer-Aided Architects: A Case Study of IT and Strategic Change. *Sloan Management Review*, 35 (4), pp 57-67.